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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/817,579 | 04/02/2004 | Yi-Chou Chen | JCLA12120 | 2590 |

23900 7590 09/29/2005

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| EXAMINER |
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HO, TU TU V

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| ART UNIT | PAPER NUMBER |
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2818

DATE MAILED: 09/29/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

H-12

Office Action Summary

Application No.

10/817,579

Applicant(s)

CHEN ET AL.

Examiner

Tu-Tu Ho

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 August 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,5-14 and 17 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,5-14 and 17 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☒ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Applicant's Amendment filed 08/03/2005 has been reviewed and placed of record in the file.
2. Applicant's arguments with respect to amended claims 1-2, 5-14, and 17, filed 08/03/2005, have been considered but they are either not persuasive or moot in view of new ground(s) of rejection.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. §103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. **Claims 1-2 and 5-12** are rejected under 35 U.S.C. §103(a) as being unpatentable over Yamada et al. U.S. Patent 6,858,277 (the '277 reference, cited in a previous office action).

Referring to **claims 1-2, 6, and 12**, the '277 reference discloses a memory device of chalcogenide phase-change non-volatile memory by doping the chalcogenide alloy with a material to enhance crystallization rate of the chalcogenide alloy as claimed, but fails to disclose a specific range of mole ratios of the element within the chalcogenide alloy as claimed. Specifically, the reference discloses in the figures, particularly Fig. 10, and respective portions of

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the specification a memory device of chalcogenide phase-change non-volatile memory and a method of fabricating a memory device of chalcogenide phase-change non-volatile memory, comprising;

a top electrode (27, Fig. 10, column 16, lines 40-45);

a bottom electrode (24); and

a phase-change thin film (26) between the top electrode and the bottom electrode,

wherein the phase-change thin film is a chalcogenide alloy (for example, Examples 12-15, columns 23-24), doped with an element (Sn) therein (column 5, lines 20-24, column 24, lines 5-10), and the element enhances a crystallization rate (“crystallization speed”, column 5, lines 20-24, column 23, lines 60-65) of the chalcogenide alloy, and wherein the mole ratio of the element within the chalcogenide alloy is in a range from 3% to 15%, preferably from 5% to 10% (column 24, lines 5-10), instead of the claimed lower than 10%.

Nevertheless, at the time the invention was made and in the pertinent art, manipulation of ratios of materials to obtain a working product, a mixture of chalcogenide alloy and Sn as in the instant case to form a storage element for a memory device of chalcogenide phase-change non-volatile memory, specifically changing from “in a range from 3% to 15%, preferably from 5% to 10%” to “lower than 10%” was still within a routine skill of an ordinary worker in the art, therefore such manipulation of ratios of materials to obtain a working product would have been obvious.

Referring to **claims 2 and 12**, as detailed above, the reference discloses that the element includes tin (Sn).

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Referring to **claim 5**, the reference further discloses that the chalcogenide alloy is $\text{Ge}_2\text{Sb}_2\text{Te}_5$ (column 8, lines 1-10).

Referring to **claims 7 and 8**, the reference further discloses that the method of forming the phase-change thin film is performed by a sputtering process using a chalcogenide target doped with the element therein (column 5, lines 40-54), and since the reference discloses that the sputtering process could include other elements, the sputtering process could be named “co-sputtering” as claimed in claim 8.

Referring to **claims 9-11**, as detailed above for claims 6-8, the reference teaches a sputtering process to enhance crystallization rate of the chalcogenide alloy as claimed for claims 7 and 8, therefore it can not be said that the reference anticipates the claimed processes of ion-implantation, diffusion, and co-evaporation of claims 9-11. However, the various processes all apparently serve the same purpose of enhancing crystallization rate of the chalcogenide alloy, therefor it also can not be said that any process is patentable over the others; hence changing the process would have been obvious to one of ordinary skill in the art.

4. **Claims 1-2, 5-12, 13-14, and 17** are rejected under 35 U.S.C. §103(a) as being unpatentable over Moore et al. U.S. Patent Application Publication 20050007852 (the ‘852 reference) in view of Yamada et al. U.S. Patent 6,858,277 (the ‘277 reference).

Referring to **claims 1-2, 6, 12, and 13-14; and 5 and 17**, the ‘852 reference discloses a chalcogenide phase-change non-volatile memory comprising a word line (106, Fig. 4), a bit line (108), which is electrically coupled to the word line, a selective device (102, Figs. 2-4), which is electrically coupled to the word line and the bit line, and a memory device (104), which is

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electrically coupled to the selective device, wherein the memory device comprises a top electrode (110, Fig. 3), a bottom electrode (114) and a phase-change thin film (no number) between the top electrode and the bottom electrode, and the phase-change thin film is a chalcogenide alloy (paragraphs [0009] and [0042]). The reference further discloses that the chalcogenide alloy comprises Ge, Sb, and Te (paragraphs [0009] and [0042]).

However, the '852 reference fails to teach that the phase-change thin film is doped with an element therein so as to enhance the crystallization rate of the chalcogenide alloy.

Nevertheless, the '277 reference, in also disclosing a memory device of chalcogenide phase-change non-volatile memory and a method of fabricating thereof substantially as claimed and as detailed above for **claims 1-2 and 5-12**, teaches doping the phase-change thin film comprising Ge, Sb, and Te alloy with an element including tin (Sn) so as to enhance the crystallization rate of the chalcogenide alloy. Specifically, the '277 reference teaches doping the phase-change thin film comprising Ge, Sb, and Te alloy with an element including tin (Sn) with a mole ratio of the element within the chalcogenide alloy being in a range from 3% to 15%, preferably from 5% to 10% (column 24, lines 5-10) so as to enhance a crystallization rate ("crystallization speed", column 5, lines 20-24, column 23, lines 60-65) of the chalcogenide alloy.

Therefore, it would have been obvious to one of ordinary skill in the art the time the invention was made to form the '852 reference's chalcogenide phase-change non-volatile memory device so that the phase-change thin film doped with an element including tin (Sn). One would have been motivated to make such a change because phase-change thin film doped

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with an element including tin enhances the crystallization rate, or as disclosed tangibly by the '277 reference as to improve crystallization speed, of the chalcogenide alloy.

With reference to the claimed limitation "lower than 10%" for said mole ratio, the '277 reference, as noted above, teaches "in a range from 3% to 15%, preferably from 5% to 10%", which is clearly not the same as "lower than 10%" as required by the claims. Nevertheless, at the time the invention was made and in the pertinent art, manipulation of ratios of materials to obtain a working product, a mixture of chalcogenide alloy and Sn as in the instant case to form a storage element for a memory device of chalcogenide phase-change non-volatile memory, specifically changing from "in a range from 3% to 15%, preferably from 5% to 10%" to "lower than 10%" was still within a routine skill of an ordinary worker in the art, therefore such manipulation of ratios of materials to obtain a working product would have been obvious.

Response to Arguments

5. In response to applicant's arguments (Pages 6 and 9, filed 08/03/2005) that Yamada (the '277 reference) does not teach a chalcogenide phase-change non-volatile memory, it is respectfully pointed out that the '277 reference does teach a chalcogenide phase-change non-volatile memory. Applicant correctly pointed out that the '277 reference teaches a DVD device; however, Applicant is not correct when stated that the '277 reference does not teach a chalcogenide phase-change non-volatile memory. At least at the time the invention was made, DVD device stores information, making the device a memory device; the information is not lost when power is not applied to the device, making it non-volatile, the DVD device, as taught by the '277 reference, comprises a phase-change chalcogenide material, making it a chalcogenide

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phase-change memory. Therefore, the '277 reference discloses a chalcogenide phase-change non-volatile memory.

6. In response to applicant's arguments (Pages 7-8, filed 08/03/2005) that Yamada (the '277 reference) does not anticipate claim 1, it is true that the '277 reference does not anticipate amended claim 1. However, amended claim 1 is unpatentable over the '277 reference, as detailed above. To summarize and to put everything into perspective, the '277 reference teaches "in a range from 3% to 15%, preferably from 5% to 10%", the present invention discloses: "The mole ratio of the element within the chalcogenide alloy is from about 0.1% to about 90%. It is preferred that the mole ratio of the element within the chalcogenide alloy is lower than 10%. The phase-change thin film 206 can be formed by any process" (present invention, paragraph [0017], Page 6). Not only that amended claim 1 is unpatentable over the '277 reference for reasons of obviousness as detailed above, it is also clear from the disclosure of the present invention that the present invention teaches the obviousness of the mole ratios (and the process of forming).

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after

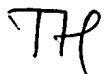
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the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tu-Tu Ho whose telephone number is (571) 272-1778. The examiner can normally be reached on 6:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, DAVID NELMS can be reached on (571) 272-1787. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Tu-Tu Ho
September 28, 2005